On-Orbit Assembly of a Universally Interlocking Modular Spacecraft (7225-020), Phase II

Completed Technology Project (2004 - 2006)

Project Introduction

Physical Sciences Inc. and Advanced Solutions, Inc. propose a novel approach for on-orbit assembly of a modular spacecraft using a unique universal, intelligent, electromechanical interface (AUTOCONNECT) on surfaces of individual modules. AUTOCONNECT not only provides mechanical fastening between modules (irrespective of precise alignments and orientations), but also automatically configures electrical connections among modules. Mechanical attachment occurs due to docking and physical contact between modules with sufficient initial momenta. The mass properties of the assembly are determined on orbit and the entire assembly functions as a spacecraft unit. In Phase I we simulated spacecraft assembly in two dimensions using instrumented hexagonal modules supported on air bearings with yaw control provided by a reaction wheel on each module. We demonstrated the feasibility of attachment via AUTOCONNECT, power and data transfer across the interface, and angular orientation control of the assembly. In Phase II, we propose to simulate orbital assembly of a spacecraft configuration as an AUTOCONNECTed assembly of multiple instrumented modules, where each module functions as a spacecraft subsystem or payload, and demonstrate command and control of the entire assembly. Additionally, we will address the system level design issues for AUTOCONNECT-equipped spacecraft modules and the concept of operations for their on-orbit assembly.

Primary U.S. Work Locations and Key Partners

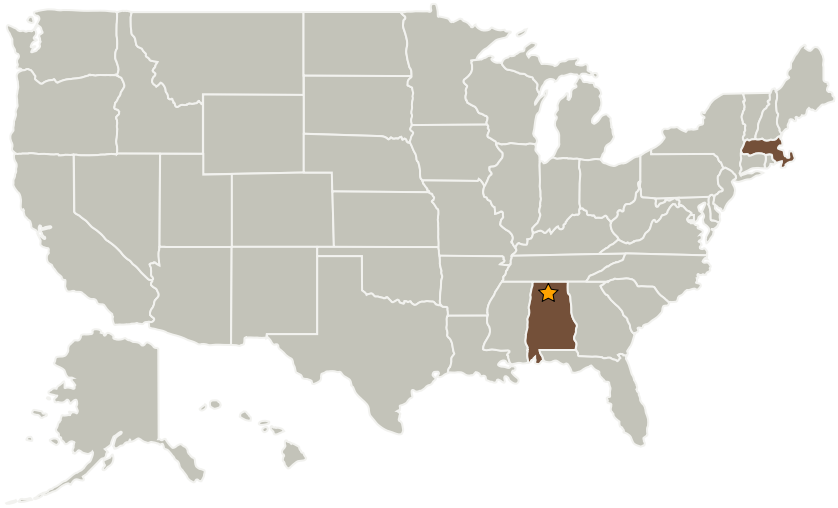

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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Physical Sciences, Inc.	Supporting Organization	Industry	Andover, Massachusetts

Primary U.S. Work Locations	
Alabama	Massachusetts

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.2 Mission Infrastructure, Sustainability, and Supportability
    - TX07.2.4 Micro-Gravity Construction and Assembly